

**U.S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM**

SCIENTIFIC NAME: *Nothocestrum latifolium*

COMMON NAME: `Aiea

LEAD REGION: Region 1

INFORMATION CURRENT AS OF: August 2005

STATUS/ACTION

☐ Species assessment - determined species did not meet the definition of endangered or threatened under the Act and, therefore, was not elevated to Candidate status

☐ New candidate

☒ Continuing candidate

☐ Non-petitioned

☒ Petitioned - Date petition received: May 11, 2004

☐ 90-day positive - FR date:

☒ 12-month warranted but precluded - FR date: May 11, 2005

☐ Did the petition request a reclassification of a listed species?

FOR PETITIONED CANDIDATE SPECIES:

a. Is listing warranted (if yes, see summary of threats below)? yes

b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? yes

c. If the answer to a. and b. is "yes", provide an explanation of why the action is precluded. We find that the immediate issuance of a proposed rule and timely promulgation of a final rule for this species has been, for the preceding 12 months, and continues to be, precluded by higher priority listing actions. During the past 12 months, most of our national listing budget has been consumed by work on various listing actions to comply with court orders and court-approved settlement agreements, meeting statutory deadlines for petition findings or listing determinations, emergency listing evaluations and determinations and essential litigation-related, administrative, and program management tasks. We will continue to monitor the status of this species as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures. For information on listing actions taken over the past 12 months, see the discussion of "Progress on Revising the Lists," in the current CNOR which can be viewed on our Internet website (<http://endangered.fws.gov>).

☐ Listing priority change

Former LP: ☐

New LP: ☐

Date when the species first became a Candidate (as currently defined): 1999

☐ Candidate removal: Former LP: ☐

☐ A – Taxon is more abundant or widespread than previously believed or not subject to

the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.

- ___ U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.
- ___ F – Range is no longer a U.S. territory.
- ___ I – Insufficient information exists on biological vulnerability and threats to support listing.
- ___ M – Taxon mistakenly included in past notice of review.
- ___ N – Taxon does not meet the Act’s definition of “species.”
- ___ X – Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Flowering plants, Solanaceae (Nightshade family)

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, islands of Kauai, Oahu, Molokai, Lanai, and Maui

CURRENT STATES/ COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, islands of Kauai, Oahu, Molokai, Lanai, and Maui

LAND OWNERSHIP: Populations of *Nothocestrum latifolium* are found scattered on State and private lands.

LEAD REGION CONTACT: Paul Phifer, 503-872-2823, paul_phifer@fws.gov

LEAD FIELD OFFICE CONTACT: Pacific Islands Fish and Wildlife Office, Christa Russell, 808-792-9400, christa_russell@fws.gov

BIOLOGICAL INFORMATION:

Species Description *Nothocestrum latifolium* is a small tree up to 10 meters (33 feet) tall, with a gnarled trunk, rigid ascending branches, and young parts with ochraceous pubescence. The thick, pubescent leaves, usually clustered toward the ends of the branches, are seasonally deciduous. Flowers occur in clusters on short spurs and have a greenish yellow corolla in which the tube is about twice as long as the calyx. Berries are yellowish orange, succulent, and depressed-globose (Symon 1999).

Taxonomy *Nothocestrum latifolium* was described by Asa Gray. This species is recognized as a distinct taxon in Wagner *et al.* (1999a) and Wagner and Herbst (2003), the most recently accepted Hawaiian plant taxonomy.

Habitat Typical habitat is dry to mesic forest and diverse mesic forests (Robert Hobdy, Hawaii Division of Forestry and Wildlife, pers. comm. 1995; Joel Lau, Hawaii Natural Heritage Program, pers. comm. 1996; John Obata, amateur botanist, pers. comm. 1996; Symon 1999).

Historical and Current Range/Current Status *Nothocestrum latifolium* is known from approximately a dozen populations totaling less than 300 individuals. While the species has not been extirpated from any island, its range on each island has decreased dramatically on all of the islands (Robert Hobdy, Hawaii Division of Forestry and Wildlife, pers. comm. 1995; Joel Lau, Hawaii Natural Heritage Program, pers. comm. 1996; John Obata, amateur botanist, pers. comm. 1996; Symon 1999; Kapua Kawelo, U.S. Army, pers. comm. 2005; Hank Oppenheimer, Maui Land and Pineapple Company, pers. comm. 2005).

THREATS:

A. The present or threatened destruction, modification, or curtailment of its habitat or range. *Nothocestrum latifolium* is threatened by ungulates, including feral pigs (*Sus scrofa*), goats (*Capra hircus*), and cattle (*Bos taurus*) (R. Hobdy, pers. comm. 1995; J. Lau, pers. comm. 1996). As early as 1778, European explorers introduced livestock, which became feral, increased in number and range, and caused significant changes to the natural environment of Hawaii. Past and present activities of introduced alien mammals are the primary factor altering and degrading vegetation and habitat. Pigs are currently present on five of the main islands, and inhabit rain forests and grasslands. While rooting in the ground in search of the invertebrates and plant material they eat, feral pigs disturb and destroy vegetative cover, trample plants and seedlings, and threaten forest regeneration by damaging seeds and seedlings. They disturb soil and cause erosion, especially on slopes. Alien plant seeds are dispersed on their hooves and coats as well as through their digestive tracts, and the disturbed soil is fertilized by their feces, helping these plants to establish. Pigs are a major vector in the spread of many introduced plant species (Smith 1985; Stone 1985; Cuddihy and Stone 1990; Medeiros *et al.* 1986; Scott *et al.* 1986; Tomich 1986; Wagner *et al.* 1999a). Ungulate exclusion fences protect some individuals of this species; however, without continued monitoring and maintenance of those fences, pigs from surrounding areas can easily access fenced areas. In addition, the remaining, unfenced individuals of this taxon are still impacted by this threat.

The goat, a species originally native to the Middle East and India, was successfully introduced to the Hawaiian Islands in 1792. Currently, populations exist on Kauai, Oahu, Maui, and Hawaii. Goats browse on introduced grasses and native plants, especially in drier and more open ecosystems. Feral goats eat native vegetation, trample roots and seedlings, cause erosion, and promote the invasion of alien plants. They are able to forage in extremely rugged terrain and have a high reproductive capacity (Clarke and Cuddihy 1980; van Riper and van Riper 1982; Scott *et al.* 1986; Tomich 1986; Culliney 1988; Cuddihy and Stone 1990). Although many plant species survive on steep cliffs inaccessible to goats, the original range of these plants was probably much larger. The dry and mesic habitats were damaged in the past by goats, and these effects are still apparent in the form of alien vegetation and erosion. This species is threatened by direct damage from feral goats, such as trampling of plants and seedlings and erosion of substrate (Corn *et al.* 1979; Clarke and Cuddihy 1980; van Riper and van Riper 1982; Scott *et al.* 1986; Culliney 1988). Ungulate exclusion fences protect some individuals of this species; however, without continued monitoring and maintenance of those fences, goats from surrounding areas can easily access fenced areas. In addition, the remaining, unfenced individuals of this taxon are still impacted by this threat.

Cattle, the wild progenitor of which was native to Europe, northern Africa, and southwestern Asia, were introduced to the Hawaiian Islands in 1793. Large feral herds developed as a result of restrictions on killing cattle decreed by King Kamehameha I. While small cattle ranches were developed on Kauai, Oahu, and west Maui, very large ranches of tens of thousands of acres were created on east Maui and Hawaii. Much of the land used in these private enterprises was leased from the State or was privately owned and classified as Forest Reserve and/or Conservation District land. Cattle eat native vegetation, trample roots and seedlings, cause erosion, create disturbed areas into which alien plants invade, and spread seeds of alien plants in their feces and on their bodies. The forest in areas grazed by cattle becomes degraded to grassland pasture, and plant cover is reduced for many years following removal of cattle from an area. Several alien grasses and legumes purposely introduced for cattle forage have become noxious weeds (Tomich 1986; Cuddihy and Stone 1990). Ungulate exclusion fences protect some individuals of this species; however, without continued monitoring and maintenance of those fences, cattle from surrounding areas can easily access fenced areas. In addition, the remaining, unfenced individuals of this taxon are still impacted by this threat.

B. Overutilization for commercial, recreational, scientific, or educational purposes.

None known.

C. Disease or predation.

Because Hawaii's native plants evolved without any browsing or grazing mammals present, many lost natural defenses to such impacts (Carlquist 1980, Lamoureux 1994). Browsing by ungulates has been observed on many other native species, including common and rare or endangered species (Cuddihy and Stone 1990; Loope *et al.* 1991). Therefore, even though we have no evidence of browsing for this species, it is likely that pigs, goats, and cattle impact this species directly as well as their indirect impacts to the surrounding habitat. Ungulate exclusion fences protect some individuals of this species; however, without continued monitoring and maintenance of those fences, pigs from surrounding areas can easily access fenced areas. In addition, the remaining, unfenced individuals of this taxon are still impacted by this threat.

D. The inadequacy of existing regulatory mechanisms.

Goats and pigs are managed in Hawaii as game animals, but many herds populate inaccessible areas where hunting is difficult, if not impossible, and therefore has little effect on their numbers. Goat and pig hunting is allowed year-round or during certain months, depending on the area (Hawaii Department of Land and Natural Resources n.d.-a, n.d.-b, n.d.-c). However, public hunting does not adequately control the number of ungulates to eliminate this threat to native plant species. Hunting of feral cattle is no longer allowed in Hawaii, except under permitted conditions (Hawaii Department of Land and Natural Resources 1985). Ungulate exclusion fences protect some individuals of this species; however, without continued monitoring and maintenance of those fences, ungulates from surrounding areas can easily access fenced areas. In addition, the remaining, unfenced individuals of this taxon are still impacted by this threat.

E. Other natural or manmade factors affecting its continued existence.

Several alien plant species threaten this species by competing with it and degrading its habitat (J. Lau and R. Hobdy, pers. comms. 1995).

The original native flora of Hawaii consisted of about 1,400 species, nearly 90 percent of which were endemic. Of the total native and naturalized Hawaiian flora of 1,817 taxa, 47 percent were introduced from other parts of the world, and nearly 100 species have become pests (Smith 1985; Wagner *et al.* 1999a). Several studies (Cuddihy and Stone 1990; Wood and Perlman 1997; Robichaux *et al.* 1998) indicate nonnative plant species may outcompete native plants similar to *Nothocestrum latifolium*. Competition may be for space, light, water, or nutrients, or there may be a chemical inhibition of other plants (Smith 1985; Cuddihy and Stone 1990). In addition, nonnative pest plants found in habitat similar to that of this species have been shown to make the habitat less suitable for native species (Smathers and Gardner 1978; Smith 1985; Loope and Medeiros 1992; Medeiros *et al.* 1992; Ellshoff *et al.* 1995; Meyer and Florence 1996; Medeiros *et al.* 1997; Loope *et al.* 2004). In particular, alien pest plant species modify habitat by modifying availability of light, altering soil-water regimes, modifying nutrient cycling, or altering fire characteristics of native plant communities (Smith 1985; Cuddihy and Stone 1990; Vitousek *et al.* 1987). Because of demonstrated habitat modification and resource competition by nonnative plant species in habitat similar to habitat of *Nothocestrum latifolium*, the Service believes nonnative plant species are a threat to *Nothocestrum latifolium*. The remaining unmanaged populations of *Nothocestrum latifolium* are still impacted by this threat.

Nonnative plants are being controlled around some individuals of this species, but will probably never be completely eradicated because new propagules are constantly being dispersed into the fenced area from surrounding, unmanaged lands. Many widespread alien taxa cannot be completely eradicated from an island or the State, and therefore are expected to disperse into previously managed areas (Loope 1998, Smith 1985). The remaining populations of the species are still impacted by this threat.

Although the reason is unknown, there is a lack of regeneration in *Nothocestrum latifolium* (R. Hobdy and J. Lau, pers. comms. 1995). The likely pollinator of all species in this genus, *Manduca blackburni* (Blackburn's sphinx moth), is federally listed as endangered. This moth has been extirpated from several islands, and this may be one of the causes of decline of *N. latifolium*. In addition, the larvae of the sphinx moth feed on *Nothocestrum* species, and the decline in *N. latifolium* and other species may be one of the causes for the decline in the sphinx moth, which is host specific to this genus (Adam Asquith, U.S. Fish and Wildlife Service (Service), pers. comm. 1997). No known conservation measures have been taken to date for this threat.

CONSERVATION MEASURES PLANNED OR IMPLEMENTED

The Service has funded several projects on Maui that provide conservation benefits to *Nothocestrum latifolium*. These projects include ungulate exclosure fences in the west Maui mountains on State and private lands, and in the State's Kahakuloa Game Management Area, which has been completed. On east Maui, the Service has provided funding for fencing on State land at Kanaio, which is still in the planning stage. In addition, the Service has funded dryland forest restoration efforts on private land at Auwahi over the last several years, including a 10-acre fence that has been completed and additional fencing that is planned.

SUMMARY OF THREATS:

The major threats to this taxon are feral pigs, goats and cattle that directly prey upon it and degrade and destroy habitat, nonnative plants that compete for light and nutrients, and the loss of pollinators that negatively affect the reproductive viability of the species, which are believed to be a major cause of the decline of this species throughout its range. Ungulates have been fenced out of some areas where *Nothocestrum latifolium* currently occurs, but the fences must be continually maintained to prevent incursion. Nonnative plants have been reduced in some populations that are fenced. These on-going conservation efforts for this species benefit only a few of the known populations. The species as a whole is still impacted by these threats and will require long-term monitoring and management to maintain threat free areas.

LISTING PRIORITY

THREAT			
Magnitude	Immediacy	Taxonomy	Priority
High	Imminent	Monotypic genus	1
		Species	2*
	Non-imminent	Subspecies/population	3
		Monotypic genus	4
		Species	5
		Subspecies/population	6
Moderate to Low	Imminent	Monotypic genus	7
		Species	8
		Subspecies/population	9
	Non-imminent	Monotypic genus	10
		Species	11
		Subspecies/population	12

Rationale for listing priority number:

Magnitude:

This species is highly threatened by feral pigs, goats and cattle that may directly prey upon it, degrade and destroy habitat, nonnative plants that compete for light and nutrients, and the loss of pollinators that negatively affect the reproductive viability of the species. Threats to the dry to mesic forest habitat of *Nothocestrum latifolium* and to individuals of this species occur throughout its range and are expected to continue or increase without control or eradication. In addition, little regeneration is observed in this species. Ungulates have been fenced out of some areas where *Nothocestrum latifolium* currently occurs, but the fences must be continually maintained to prevent incursion. Nonnative plants have been reduced in some populations that are fenced. These on-going conservation efforts for this species benefit only a few of the known populations. The species as a whole is still impacted by these threats and will require long-term monitoring and management to maintain threat free areas.

Imminence:

Threats to *Nothocestrum latifolium* from feral pigs, goats and cattle, nonnative plants, and the loss of pollinators, are imminent because they are ongoing.

Yes Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed?

Is Emergency Listing Warranted? No. The species does not appear to be appropriate for emergency listing at this time because the immediacy of the threats is not so great as to imperil a significant proportion of the taxon within the time frame of the routine listing process. In addition, the Service has funded conservation actions that will benefit *Nothocestrum latifolium*, such as ungulate exclosure fences and dryland forest restoration efforts, on State and private lands on Maui. If it becomes apparent that the routine listing process is not sufficient to prevent large losses that may result in this species' extinction, then the emergency rule process for this species will be initiated. We will continue to monitor the status of *N. latifolium* as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures.

DESCRIPTION OF MONITORING:

Much of the information in this form is based on the results of two meetings of 20 botanical experts held by the Center for Plant Conservation in December 1995 and November 1996, and was updated by personal communication with Robert Hobdy, Hawaii Division of Forestry and Wildlife in 1995; Joel Lau, Hawaii Natural Heritage Program, in 1995 and 1996; John Obata, amateur botanist, in 1996; and Adam Asquith, U.S. Fish and Wildlife Service, in 1997. We have incorporated additional information on this species from our files and the most recent supplement to the *Manual of the Flowering Plants of Hawaii* (Wagner and Herbst 2003). In 2004, the Pacific Islands office contacted the following species experts: Bob Hobdy, retired from Hawaii Division of Forestry and Wildlife; Joel Lau, Hawaii Natural Heritage Program; Art Medeiros, U.S.G.S. Biological Resources Discipline; Hank Oppenheimer, resource manager for Maui Land and Pineapple Company; and Steve Perlman and Ken Wood, National Tropical Botanical Garden. No new information on status or range was provided in 2004. In 2005 we contacted the species experts listed below and confirmation of the status of *Nothocestrum latifolium* was provided by Kapua Kawelo, U.S. Army, and Hank Oppenheimer, Maui Land and Pineapple Company.

The Hawaii Natural Heritage Program identified this subspecies as critically imperiled (Hawaii Natural Heritage Program Database 2004). Based on the International Union for Conservation of Nature and Natural Resources Red Plant Data Book rarity categories, this species is recognized as Rare (could be considered at risk) by Wagner *et al.* (1999b).

Species experts have provided new information confirming the status of the species this year and the results are included in this assessment.

COORDINATION WITH STATES:

In October 2004 we provided the Hawaii Division of Forestry and Wildlife with copies of our most recent candidate assessments for their review and comment. Vickie Caraway, the State

botanist, reviewed the information for this species and provided no additional information or corrections (V. Caraway, pers. comm. 2005).

LITERATURE CITED

List all experts contacted:

Name	Date	Place of Employment
1. Joel Lau	June 28, 2005	Hawaii Natural Heritage Program
2. Art Medeiros	June 28, 2005	U.S.G.S. Biological Resources Discipline
3. Linda Pratt	June 28, 2005	U.S.G.S. Biological Resources Discipline
4. Rick Warshauer	June 28, 2005	U.S.G.S. Biological Resources Discipline
5. Hank Oppenheimer*	June 28, 2005	Maui Land and Pineapple Company
6. Kapua Kawelo*	June 28, 2005	U.S. Army
7. Dave Lorence	June 28, 2005	National Tropical Botanical Garden
8. Steve Perlman	March 29, 2005	National Tropical Botanical Garden
9. Ken Wood	August 2, 2005	National Tropical Botanical Garden
10. Marie Brueggmann	July 13, 2005	U.S. Fish and Wildlife Service
11. Vickie Caraway	June 14, 2005	Hawaii Division of Forestry and Wildlife

*Provided new information on this taxon in 2005

List all databases searched:

Name	Date
1. Hawaii Natural Heritage Program	2004

Other resources utilized:

Carlquist, S. 1980. Hawaii: A natural history, 2nd edition. Pacific Tropical Botanical Garden, Honolulu. 468 pp.

Center for Biological Diversity, Dr. Jane Goodall, Dr. E.O. Wilson, Dr. Paul Ehrlich, Dr. John Terborgh, Dr. Niles Eldridge, Dr. Thomas Eisner, Dr. Robert Hass, Barbara Kingsolver, Charles Bowden, Martin Sheen, the Xerces Society, and the Biodiversity Conservation Alliance. 2004. Hawaiian Plants: petitions to list as federally endangered species. May 4, 2004.

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Ellshoff, Z.E., D.E. Gardner, C. Wikler, and C.W. Smith. 1995. Annotated bibliography of the genus *Psidium*, with emphasis on *P. cattleianum* (strawberry guava) and *P. guajava* (common guava), forest weeds in Hawai'i. Cooperative National Park Resources Studies Unit, University of Hawaii. Technical Report 95.

Hawaii, Department of Land and Natural Resources. N.d.-a. Summary of Title 13, Chapter 123, Game mammal hunting rules, island of Oahu. Division of Forestry and Wildlife, Honolulu. 2 pp.

Hawaii, Department of Land and Natural Resources. N.d.-b. Summary of Title 13, Chapter 123, Game mammal hunting rules, island of Molokai. Division of Forestry and Wildlife, Honolulu. 2 pp.

Hawaii, Department of Land and Natural Resources. N.d.-c. Summary of Title 13, Chapter 123,

- Game mammal hunting rules, island of Maui. Division of Forestry and Wildlife, Honolulu. 2 pp.
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- Loope, L.L. and A.C. Medeiros. 1992. A new and invasive grass on Maui. Newsletter of the Hawaiian Botanical Society 31: 7-8.
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APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes to the candidate list, including listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all 12-month petition findings, additions of species to the candidate list, removal of candidate species, and listing priority changes.

Approve: **Acting** David W. Winkler 11/10/05
Regional Director, Fish and Wildlife Service Date

Marshall P. Jones

Concur: _____ August 23, 2006
Director, Fish and Wildlife Service Date

Do not concur: _____
Director, Fish and Wildlife Service Date

Date of annual review: September 20, 2005
Conducted by: Marie M. Brueggmann, Pacific Islands FWO
Plant Recovery Coordinator

Comments:
PIFWO Review

Reviewed by: Christa Russell Date: September 26, 2005
Plant Conservation Program Leader

Gina Shultz Date: October 14, 2005
Assistant Field Supervisor,
Endangered Species

Patrick Leonard Date: October 14, 2005
Field Supervisor